L2 Tracking Preprocessor

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Outline:

Purpose

Basic Assumptions

Preprocessor Structure

L1 Information from the CFT

L2 CFT Preprocessor

L2 Silicon Tracker Preprocessor

Purpose

Displaced Vertex Trigger:

Average decay path of B’s is 500 um
Average decay path of C/S is (140-460)um
Average decay path of tau is 90 um

Silicon track resolution is 40 um (Cell size is 50 um)

Transverse beam spot is 30 um

For Pt > 2 GeV and impact parameter cut > 140 um

B eff is reduced by a factor of 5
Minimum bias tracks are suppressed by 4 x 10^4

CFT Tracker:

Combine u/v information with axial track candidates

eta and phi info for lepton track candidates
fakes reduced by as much as a factor of 8

Basic Assumptions

CFT and Silicon L2 are interdependent.
Only CFT axial information/seeds will be available at L1 accept
Will want to look at as many track candidates as possible

  all of the 6 maximum track candidates from each CFT L1 Sector
  want to go to lowest Pt min possible
  Pt min of 1.5 GeV => < 6 tracks 95% of the time

Several possible configurations

1 - L1 axial from CFT -
  r Phi track match in L2 Silicon

2 - L1 axial from CFT
  L2 CFT stereo used for Z fit
  r, Phi, Z track match in L2 Silicon

3 - L1 axial from CFT
  in parallel:
    r Phi track match in L2 Silicon
    L2 CFT stereo used for Z fit
  {r, Phi, Z track match in L2 Silicon}

The preprocessor(s) must be finished in 50 usec

The data size to the Global L2 must be small

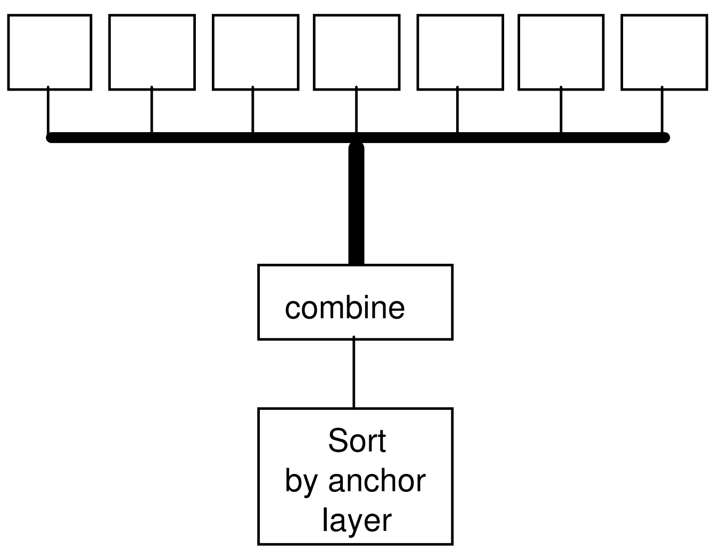
L1 Information from the CFT

On L1 accept need:

- fiber hit ID from A, C, E, G and H layers
  - A and H were sent to L1
  - C, E and G (A & H) must be held in CFT FE until L1 accept
  - special data path form CFT FE to Tracker L2 Preprocessor
    - 8 bits x 5 layers x 6 hit candidates = 240 bits

- Combine L1 FE data from 7 CFT sectors (of 80)
  - 240 bits x 7 L1 sectors = 1680 bits

- Sort L1 FE data by intercept
  - either by H layer or A layer intercept



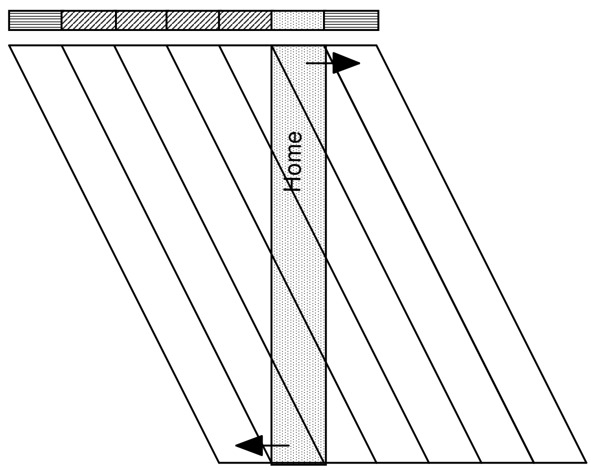
L2 CFT Preprocessor:

Stereo Fiber Layers

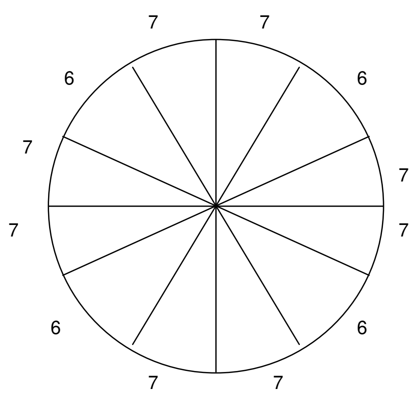
Layer	Stereo Angle			Stereo Offset			
	rad/cm	rad	deg	cm	fibers	sectors	
A	0.00000000	0.00000000	0.000	0.000	0.0	0.0	
A-U	0.00176671	0.03474589	1.991	5.768	60.3	3.8	
A-V	0.00175200	0.03474917	1.991	5.768	60.3	3.8	
B	0.00000000	0.00000000	0.000	0.000	0.0	0.0	
C	0.00000000	0.00000000	0.000	0.000	0.0	0.0	
C-U	0.00121819	0.03442483	1.972	8.675	94.4	3.9	
C-V	0.00121118	0.03442900	1.973	8.676	94.4	3.9	
D	0.00000000	0.00000000	0.000	0.000	0.0	0.0	
E	0.00000000	0.00000000	0.000	0.000	0.0	0.0	
E-U	0.00091497	0.03442392	1.972	8.675	94.4	2.9	
E-V	0.00091101	0.03442707	1.973	8.676	94.4	2.9	
F	0.00000000	0.00000000	0.000	0.000	0.0	0.0	
G	0.00000000	0.00000000	0.000	0.000	0.0	0.0	
G-U	0.00073261	0.03583708	2.053	9.031	94.3	2.4	
G-V	0.00073007	0.03583476	2.053	9.030	94.3	2.4	
H	0.00000000	0.00000000	0.000	0.000	0.0	0.0	
How many stereo fibers cross each axial fiber?							
This table uses the current stereo angles in column B and other fiber parameters from							
the 'Official FTG Baseline' spread sheet to calculate this value in cm and fibers.							

Each axial fiber is crossed by 60 or 94 fibers
On A and C layers this is 4 sectors

One more sector must be added for curvature of the low Pt tracks



The basic sector size of the L2 CFT is then 7 L1/FE sectors



Divide the CFT into **12** L2-Sectors each of which is 7/6 FE sectors wide.

L2 Silicon Preprocessor:

Barrel only
12 independent sectors (ladders overlap)
4 layers (L1, L2, L3, L4)
7 barrells

Layer	Width	Type
L1	3	axial + (90 Stereo)
L2	5	axial + SA Stereo
L3	3 + 3	axial + (90 Stereo)
L4	5 + 5	axial + SA Stereo

The cell count for each silicon sector:

layer	Raduis (mm)	Width	# of cells	Sides	Cell count	for 7 barrels	Occupancy	Occupied Cel
L1	30	3	384	1	384	2688	5%	134.4
L2	50	5	640	2	1280	8960	5%	448
L3	70	6	768	1	768	5376	5%	268.8
L4	95	10	1280	2	2560	17920	5%	896
Total for sector					4992	34944	5%	1747.2

The cell count for a road in the silicon detector:

layer	Raduis (mm)	Road Width	# of cells	u/v Factor	Sides	Cell count	for 7 barrel
Beam	*0*	*500*					
L1	30	500	10	0	1	10	70
L2	50	500	10	42	2	52	364
L3	70	500	10	0	1	10	70
L4	95	800	16	42	2	58	406
CFT A	*200*	*1000*	*20*				
Total for Sector						130	910
	910 x 5% = 46 cells from random occupancy						
	6 layers x 2.5 cells per hit = 15 cells for real hit						
	Therefore expect 61 cells per CFTL1 track						

Summary:

A L2 preprocessor for tracking could involve just the CFT, Silicon Tracker or both.

A displaced vertex preprocessor using only r, phi information (CFTL2 only and silicon axial only) could be built and could meet the time budget. Option 1 is buildable.

A preprocessor that did CFT Z fitting and then Silicon Z fitting serially would probably take too long. Option 2 is out.

Option 3 without the { } could fit into the time budget.